

Efficiency and Reducing Unwanted Energy transfers 3

Q:1 A wood burning stove is used to heat a room.



The fire in the stove uses wood as a fuel. The fire heats the matt black metal case of the stove.

(a) The air next to the stove is warmed by infrared radiation.

How does the design of the stove help to improve the rate of energy transfer by infrared radiation?

(2 marks)

(b) Burning 1 kg of wood transfers 15 MJ of energy to the stove. The stove then transfers 13.5 MJ of energy to the room.

Calculate the efficiency of the stove.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

Efficiency = _____

(2 marks)

(c) Some of the energy from the burning wood is wasted as the hot gases leave the chimney and warm the air outside the house.

Name one other way energy is wasted by the stove.

(1 mark)

(d) Some people heat their homes using electric heaters. Other people heat their homes using a wood burning stove.

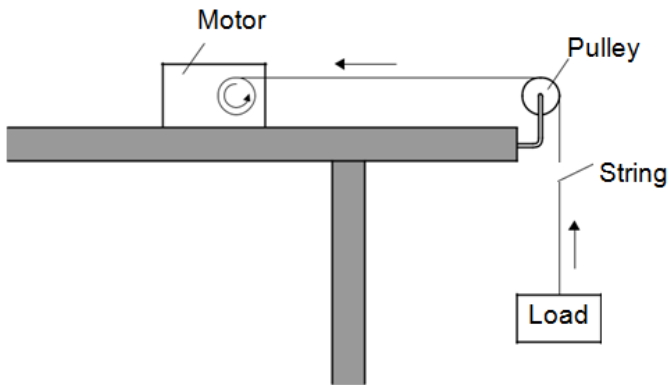
Give two environmental advantages of using a wood burning stove to heat a home rather than heaters that use electricity generated from fossil fuels.

1 _____

2 _____

(2 marks)

Q:2 A student uses an electric motor to lift a load.



In the motor, the electrical energy is transferred into other types of energy. Some of this energy is useful and the rest of the energy is wasted.

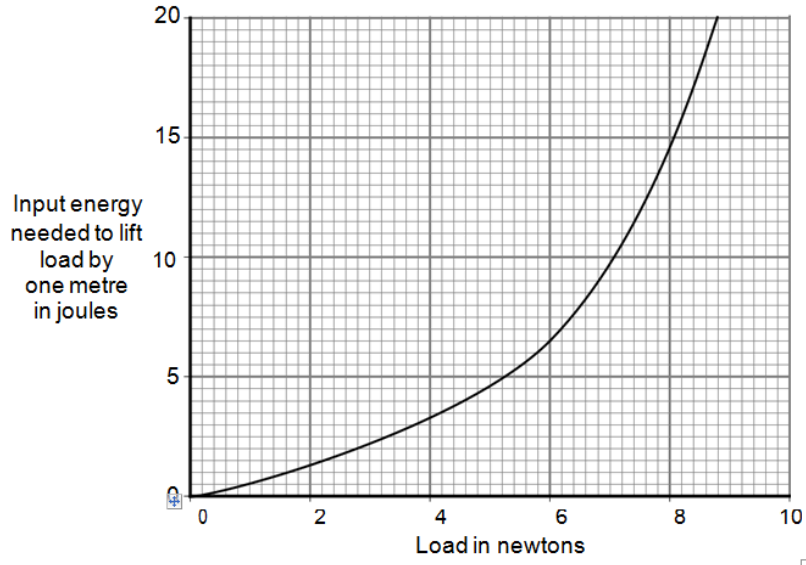
(a) (i) Name the useful energy output from the electric motor.

(1 mark)

(a) (ii) What eventually happens to the wasted energy?

(1 mark)

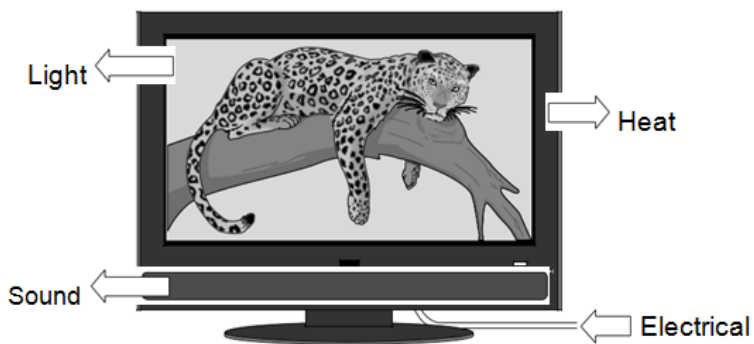
(b) The graph shows the input energy the motor needs to lift different loads by one metre.



What can you conclude from the graph about the relationship between the load lifted and the input energy needed?

(2 marks)

Q:3 (a) The diagram shows the energy transformations produced by a television.



When the television is working, 1200 joules of energy are supplied to the television every second. The useful energy transferred by the television is 720 joules every second.

(a) (i) Use the equation in the box to calculate the efficiency of the television.

$$\text{Efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

Show clearly how you work out your answer.

Efficiency = _____

(2 marks)

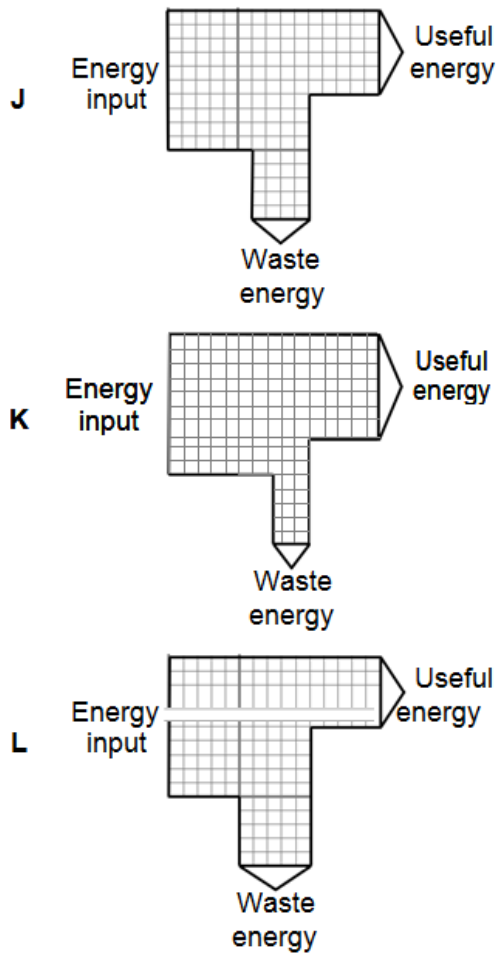
(a) (ii) Use one word from the diagram to complete the following sentence.

The electrical energy that is not usefully transformed by the television is wasted as

(1 mark)

(b) Drawn below are the Sankey diagrams for three televisions, J, K and L.

The diagrams are drawn to the same scale.



Which one of the televisions, J, K or L, is the most efficient?

Write your answer in the box.

Give a reason for your answer.

(2 marks)

Q:4 A homeowner had a new gas boiler installed.

(a) The following information is an extract from the information booklet supplied with the boiler.

Fuel	Natural Gas
Water temperature	60 °C
Energy supplied to gas boiler	8.0 kJ/s (8.0 kW)
Efficiency	0.95

(a) (i) Use the equation in the box to calculate the energy transferred each second by the gas boiler to the water inside the boiler.

$$\text{Efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

Show clearly how you work out your answer.

Energy transferred by the gas boiler each second = _____ kJ

(2 marks)

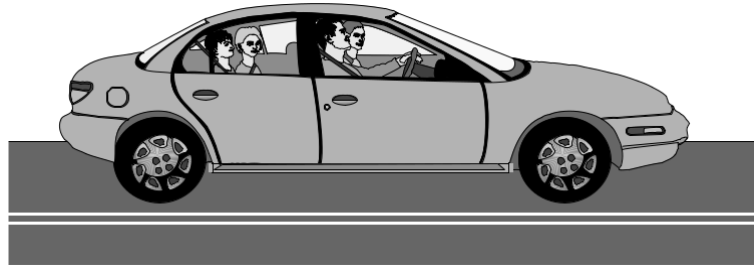
(b) Although the gas boiler is very efficient, some energy is wasted.

Explain what happens to the waste energy.

(2 marks)

Q:5 Figure 1 shows a car with an electric motor. The car is moving along a flat road.

Figure 1



(a) (i) Use the correct answers from the box to complete each sentence.

light electrical kinetic potential sound

The car's motor transfers _____ energy into useful _____ energy as the car moves. Some energy is wasted as _____ energy.

[3 marks]

(a) (ii) What happens to the wasted energy?

[1 mark]

(b) The electric motor has an input energy of 50 000 joules each second.

The motor transfers 35 000 joules of useful energy each second.

Calculate the efficiency of the electric motor.

Use the correct equation from the Physics Equations Sheet.

Efficiency = _____

(2 marks)

TOTAL MARKS=26